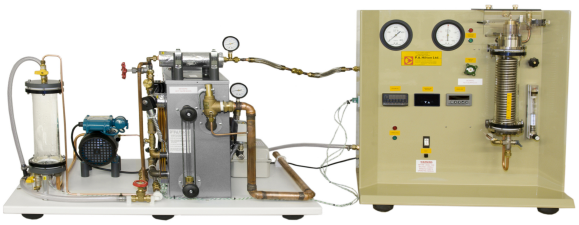
RANKINE CYCLE STEAM TURBINE

S220



Year 1
study

Features

- Operates on a true Rankine Cycle with boiler, turbine, feed-pump and condenser.
- Stabilises in minutes and allows rapid data collection.
- Bench top unit allows similar experimental procedures to full size plant.
- Optional power generation module.
- Optional Computerised Data Acquisition

Description

The unit is supplied as two complimentary modules. An independently certified electric boiler with safety valve, automatic control system and fail safe pressure switches, provides steam at up to 8 Bar gauge to a solenoid valve. This in conjunction with an optical sensor limits the maximum turbine speed to a safe level. Steam flow to the turbine can be throttled by a hand valve and the boiler, turbine inlet and condenser pressures are indicated on gauges.

The impulse turbine is driven by a convergent divergent nozzle and turns a brake wheel with speed sensor and digital indicator allowing true shaft power to be determined. An optional electrical power generator is also available for demonstration purposes.

The turbine exhausts into a condenser and this passes water to a similar water reservoir. The reservoir connects to a boiler feed pump. Like full size real power plant the condenser operates at sub-atmospheric pressure and the unit incorporates an air extraction system. The boiler feed pump and non-return valves to the boiler complete the full Rankine cycle.

Instrumentation includes all relevant system pressures, system temperatures, and cooling water flow rates, turbine speed and brake load. A combination of digital

and analogue displays show the recorded parameters.

Related laws

- Thermodynamics
- Heat Transfer
- Chemical Engineering
- Mechanical Engineering
- Power Engineering
- Marine Engineering
- Plant and Process Engineering

Learning capabilities

- Investigation of a true Rankine Cycle Steam plant.
- Determine of cycle thermal efficiency based on shaft power.
- Determination of friction losses at various exhaust pressures.
- Investigation of turbine torque/speed and power/speed characteristics.
- Investigation of steam quality by throttling.
- With the optional power generation module demonstration of electrical power generation.

Technical Specification

- Boiler:
- - Independently certified electric boiler with automatic control
- - Pressure switches
- - Fail safe pressure cut out and large capacity relief valve
- Turbine:
- - Single stage, axial flow impulse (De Laval) turbine on a vertical shaft mounted in corrosion resistant sealed ball bearings.
- - Convergent-divergent nozzle discharges at 20° to plane of turbine rotation
- - Rotor has blades with 40° inlet and discharge angles.
- - Rotor Ø50mm.
- - Maximum turbine speed 40,000 rpm.
- Water cooled Condenser: Condenses turbine exhaust steam allowing heat rejection from the system to be measured.
- Feed Water Reservoir: Collects condensate from the condenser for return via the feed pump to the boiler.
- Feed Pump: low volume flow pump.
- Flow Meters: For condenser cooling water. Allows measurement of heat rejection from the condenser.
- Digital Thermometer: 0.1°C resolution, with multi-way selector switch for all relevant temperatures
- Pressure gauges: For all relevant system pressures.
- Turbine Tachometer: Digital display and over speed cut out.
- Turbine brake load: Digital indicator.

Recommended Ancillaries

- S220A

What's in the Box?

- 1 x S220
- 3 x 3m Reinforced PVC hose
- 1 x Power lead
- Couplings
- Insulation
- Gloves and ear defenders
- 2 x Brake band
- 2 year spares ('o' rings and seals)
- Instruction manual
- Packing list
- Test sheet

Weights & Dimensions

- Weight: 118 kg
- Length: 2000mm
- Width: 655mm
- Height: 650mm

Essential Services

- 6.0kW, 380/415Volts, 3 phase + neutral, 50Hz (With earth/ground).
- 6.0kW, 210/220Volts, 3 phase, 60Hz (With earth/ground).
- 6.0kW, 220/230Volts, single phase, 50Hz (With

earth/ground).

- Cold Water: Continuous supply 5 litres/ minute at 25m head, intermittent supply at 25 Litre/minute.
- Boiler Feed: Water Small quantity (10litres) de-mineralised or distilled for initial fill. Then approximately 1 litre/10 hours running.

Ordering information

To order this product, please call PA Hilton quoting the following codes:
S220/415
S220/220
S220/230
S220/415/SC
S220/220/SC
S220/230/SC